

Economic Evaluation of Water Management Alternatives

Status Report -- March 2, 1999

Through the development of a Water Management Strategy, CALFED is seeking to define specific water management objectives and describe how available tools might be integrated to meet those objectives. To aid in formulating and refining its Water Management Strategy, CALFED has undertaken an Economic Evaluation of Water Management Alternatives (EEWMA). The primary purposes of the EEWMA are twofold: 1) to define how policy assumptions and preferences could affect the selection of water management tools that define the Water Management Strategy and 2) to help evaluate the potential environmental, economic, and social benefits and impacts of alternative Water Management Strategies.

Two efforts are underway to meet the primary purposes of the EEWMA. Under a *Scenario Development* effort, policy assumptions and preference sets of various stakeholder groups are being defined through an outreach process. These assumption sets will be used to define alternative water management scenarios. Under a *Hydrologic-Economic Impact Modeling* effort, a number of hydrologic and economic models are being linked together to evaluate the benefits and impacts of alternative water management scenarios. Together, these efforts should provide CALFED policy-makers with a better understanding of the potential consequences of water management decisions.

Scenario Development

As part of the *Scenario Development* effort, CALFED is developing a range of the most cost-effective water management options (or "scenarios") to meet future California water needs in 2020. The scenarios, which include both demand reduction and supply augmentation options, will be constrained by policy assumptions and preferences obtained from a variety of stakeholder groups. The matrix displayed in Figure 1 summarizes to date these policy assumptions and preference sets for each of the identified stakeholder groups.

Since fall of 1998, stakeholder input has been acquired from monthly workshops, interviews with individuals representative of stakeholder groups, and comment letters that organizations have provided in response to the Department of Water Resources' Bulletin 160-98 or CALFED documents. Following is a list of these individuals and organizations:

Stakeholder Group	Interview	Comment Letter
EPA/COE	Carolyn Yale/EPA Jim Monroe/COE	
Environmental	Spreck Rosenkrans/EDF Barry Nelson/STB Ronnie Cohen/NRDC	Bay Institute Pacific Institute Environmental Water Caucus Save the Bay
Urban Delta Exporters	Tim Blair/MWD B.J. Miller/SCVWD CUWA Planning Directors	Metropolitan Water District Santa Clara Valley water District California Urban Water Agencies
Urban In-Delta Diverters	CUWA Planning Directors	Contra Costa Water District Solano County Water Agency
Delta Agriculture	Tom Zuckerman/CDWA	Central Delta Water Agency South Delta Water Agency
Sacramento Valley Agriculture	Dan Keppen/NCWA Bill Curtis/NCWA	Glenn Colusa Irrigation District
San Joaquin Valley Agriculture	B.J. Miller/SLDMWA Laura King/SLDMWA Terry Erlewine/SWC	San Luis Delta Mendota Water Authority

The policy assumptions and preferences are continually being refined as additional input and information is received from stakeholders. Some assumptions will require further definition before they can be evaluated. It is expected that the policy assumptions and preference sets will continue to evolve as stakeholders begin to see the implications of various constraints.

A supply and demand screening analysis will provide a "first cut" view of the most cost-effective combination of water supply options that meet demands subject to the specific constraints of a stakeholder's policy assumption and preference set. These initial scenarios will be refined using screening tools including the Central Valley Production and Transfer Model (CVPTM). The linked hydrologic-economic modeling system described below will be used to further refine the scenarios.

Recent activities on each of the scenario development tasks and the task status is summarized below:

Policy Assumptions and Preference Sets Matrix. Refinement of the Policy Assumptions and Preference Sets Matrix based on input and information provided by stakeholder groups is ongoing. A method to define the meaning of "full practicable amount" is being developed with assistance from EPA and COE. The CUWA Planning Directors were briefed on the Policy Assumptions and Preference Sets Matrix and the Scenario Development Methodology and feedback was received. A meeting with Laura King and other agricultural stakeholders is being rescheduled.

Demand Functions. Urban demand functions based on DWR and CALFED studies and input from Dr. Richard Howitt have been developed. A method to resolve potential

"double counting" of urban water conservation has been completed and is being reviewed with experts. Regional agricultural demand functions are nearing completion.

Supply Data. Work continues on gathering and checking supply data (costs and yields) for various option types from water management agencies and stakeholder groups. Individual experts for each of the supply option types are being contacted and review of the basic supply data is being requested.

Supply and Demand Screening Analysis. The screening analysis for the Unconstrained Policy Assumptions and Preference Set has been completed. This screening analysis has revealed several stakeholder concerns (e.g. price of water from Land Fallow and quantity of water from Agriculture Urban Water Use Efficiency). These concerns are being addressed. The screening analyses for each of the other Policy Assumptions and Preference Sets is nearing completion.

Analysis Issues. Eight analysis issues have been identified to date. Resolutions have been proposed for six of the issues (Colorado River Aqueduct deliveries, groundwater management, scenario development "baseline", market effect on water transfers, treatment for potable supply, and timeframe) and work continues on the remaining two (urban drought-contingency conservation and demand elasticity).

CVPTM and Spreadsheet Analysis. Spreadsheets are being developed to allow CVPTM to consider statewide supply data, demand functions, and transfer costs. The CVPTM analysis for the Unconstrained Policy Assumptions and Preference Set is nearing completion.

Over the next several months, CALFED will continue to refine the Policy Assumption and Preference set matrix and complete an initial supply and demand screening analysis using the sets of assumptions identified. The resulting scenarios will represent alternative water management strategies that will could be considered by CALFED policy-makers and subjected to further evaluation. The work currently scoped for the *Scenario Development* process is scheduled for completion by June 1999.

Hydrologic-Economic Impact Modeling

The primary objective of the *Hydrologic-Economic Impact Modeling* effort is to provide integrated hydrologic and economic evaluations of various water management alternatives. To meet this objective, CALFED is developing an analytical process that links several existing computer-based models that simulate both the hydrologic and economic consequences of statewide water management decisions. The resulting modeling system will enable evaluation of alternative trends in water supply, water use and economic conditions.

The modeling system is composed of five models, including a statewide system operation model (DWRSIM), an upstream hydrology model (DWR Hydrology Procedure), a groundwater model (CVGSM), a Central Valley agricultural production model (CVPTM), and an urban water economic model (LCPSIM). The models will be used individually or in pairs for limited applications or collectively for comprehensive

evaluations to estimate changes in major reservoir operations, Bay-Delta system instream flows, land use and crop production, ground water levels, pumping costs, regional water use, and net farm income under different management policies and water supply conditions. A schematic of the linked hydrologic-economic modeling system is shown in Figure 2.

CALFED is in the process of linking the models by developing a database and various application programs. These efforts will allow the models to share data and to collectively account for policy assumptions and preferences. Because all the models were not designed to interact, some adaptation of the individual models will be required. While similar modeling work has been completed on a regional basis, no previous hydrologic-economic modeling effort has been conducted for an area as extensive and complex as the State of California. This innovative work will require considerable time and resources. An initial version of the entire linked modeling system is scheduled for completion in early 2000. In the meantime, CALFED is conducting several independent studies to explore model interrelationships. These "linkage studies" will provide insight into the relationships between land use, surface water conditions, groundwater levels, and economic conditions and will help CALFED evaluate various water management scenarios over the next several months.

The following provides an update on the hydrologic-economic modeling process:

Model Linkage Studies. CALFED is currently conducting several independent studies to explore interrelationships between the systems operations model and other models. Each model is being evaluated under varying Delta water supply allocations while defining other inputs through various "bookend" assumptions. Each of the primary model linkages outlined below will be evaluated to define the system response to various water management activities.

- Upstream Hydrology Link. Several upstream water transfer scenarios (e.g. land fallowing or groundwater conjunctive use) will be evaluated under different water demands, Delta constraints and facility assumptions. This link requires interactions between upstream hydrology, system operations, and groundwater to be modeled.
- Groundwater Link. The impacts of several Delta supply allocations on Central Valley groundwater will be evaluated. Some scenarios result in additional water transfers from the Tulare Lake Basin to other regions in the State. CVGSM is being used to evaluate the groundwater conditions and groundwater/surface water interaction within the Central Valley.
- Agricultural Land Use (willingness to sell/buy). The impacts of Delta water supply allocations on land use changes (including the cost of land fallowing) will be evaluated. By estimating the marginal value of water used in agricultural crop production, CVPTM identifies the minimum price that agricultural water users would accept to transfer water that would be made available through land fallowing.

- Urban Economics (willingness to buy). The impacts of Delta water supply allocations on urban economics will be assessed. LCPSIM is being used to evaluate cost-effective options available to urban water users.

An initial evaluation of these model linkages will be completed by June 1999. The information developed by this effort will be used to refine the water management scenarios described previously.

Linked Model Development. The linked hydrologic-economic modeling system will include system operations, upstream hydrology, groundwater, agricultural economics and urban economic models. The linkage mechanism consists of: 1) base input sets for each model, 2) a database to store and share data, and 3) application programs that query the database and generate input sets for each model, accounting for policy assumptions and preferences. Information developed through the model linkage studies described above will be used to develop the application programs. Experience gained through the model linkage studies will be used to determine the degree of automation required for the linked modeling system. An initial version of the entire linked model system is scheduled for completion in early 2000. It is expected that this tool will undergo continuous refinement and provide policy-makers with constructive information as CALFED's water management strategy is refined and implemented.

Figure 1

Revised Policy Assumptions and Preferences for 2020 Demands and 1995 Supplies February 25, 1999								
	Uncon- strained and No Subsidies	EPA/COE (404 Permitting)	Environmental	Urban Delta Exporters	Urban In-Delta Diverters	Delta Agriculture	Sacramento Valley Agriculture	San Joaquin Valley Agriculture
Urban Water Use Efficiency	Uncon- strained	Minimum: Full amount practicable based on ability to pay.	Unconstrained	Maximum: B.160-98 except 632,000 AF in South Coast.		Minimum: B.160- 98 plus Local Options in Tables 7-13, 7-18, 7-30, 8- 5, 8-12, 8-17	Unconstrained	
Agricultural Water Use Efficiency	Uncon- strained	Minimum: Full amount practicable based on ability to pay.	Unconstrained					
Urban Recycling	Uncon- strained	Minimum: Full amount practicable based on ability to pay.	Minimum: Calfed's common program 1.1 maf.	Maximum: B.160-98 except 500,000 AF in South Coast.		Minimum: Calfed's common program 1.1 maf.	Unconstrained	
Land Fallow	Unconstrained			?	?	Maximum: No permanent land retirement for water supply. Limit the total land fallow for water supply in dry years to 5 percent of land irrigated with surface water within any region.	Maximum: No permanent land retirement for water supply. Limit the total land fallow for water supply in dry years to 5 percent of land irrigated with surface water within any region. Transfers among SWP contractors constrained by Monterey Amendment.	
Passive Conjunctive Use	Maximum: Water supply by groundwater substitution limited to safe yield.						Maximum: Groundwater substitution allowed up to 200,000 acre-feet per year in dry and critical years subject to no adverse groundwater impacts and no substitution in overdrafted basins.	
Active Conjunctive Use	Unconstrained						Maximum: 250,000 acre-feet of storage.	Maximum: 1,000,000 acre-feet of storage.
New Surface Storage	Unconstrained		Maximum: None	Unconstrained	Maximum: None in delta unconstrained otherwise.	Maximum: None	Minimum: In Sacramento Valley additional amount needed to make up for past losses. In Sacramento Valley first, then San Joaquin Valley.	Unconstrained
Delta Conveyance	Uncon- strained	No isolated facility. Include South Delta improve- ments.	No isolated facility	Include isolated facility (10k)	No isolated facility until priority of regional water rights is assured.	No isolated facility	No isolated facility until priority of regional water rights is assured.	Include isolated facility (5k, 10k or 15k)
Criteria for Cost Allocation, Water Allocation, and Pricing	No subsidies to agricultural or urban water users. Water supply allocated based on willingness to pay. Marginal cost pricing of new water supply.			Assign a share (50%) of isolated facility costs to environmental purpose and calculate water cost shares accordingly. Average cost pricing.	If adverse water quality impacts found, charge beneficiaries to recover full mitigation costs. Average cost pricing.		Subsidize so that agriculture receives water supply at current contract amounts and costs. Average cost pricing of new water supply.	
SOURCE Individuals and Organizations:		Carolyn Yale/EPA Jim Monroe/COE	Spreck Rosenkrans/EDF Barry Nelson/STB Ronnie Cohen/NRDC	Tim Blair/MWD B.J. Miller/SCVWD CUWA	CUWA	Tom Zuckerman/ CDWA	Dan Keppen/NCWA BillCurtis/NCWA	B.J. Miller/SLDMWA Laura King/SLDMWA Terry Erlewine/SWC
Comment Letters on Bull 160-98 or Calfed:			Bay Institute Pacific Institute EWC STB	SCVWD MWD CUWA	CCWD SCWA	CDWA SDWA	GCID	SLDMWA

Maximum = Scenario includes cost-effective options up to but not more than amount specified

Minimum = Scenario includes specified options even if other options are less expensive

Unconstrained = Scenario includes any cost-effective option given willingness to pay

Linked Hydrologic-Economic Modeling System

Figure 2

